Random fatigue crack growth in mixed mode by stochastic collocation method

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Mots-clés	Probabilistic fatigue crack growth [4], reliability [5], Stochastic collocation [6], Uncertainties [7]
Résumé en anglais	Fatigue crack growth is uncertain, either for cracking rate or direction. The stochastic models proposed in the literature suffer from limited applicability or lack of physical meaning. In this paper, a new stochastic collocation method is proposed to solve mixed mode fatigue crack growth problems with uncertain parameters. This approach has the advantage of non-intrusive nature methods, such as Monte-Carlo simulations, since it allows us to decouple the stochastic and the mechanical computations. The proposed numerical implementation is very simple, as it requires only repetitive runs of deterministic finite element analysis at some specific points in the random space. The method describes a precise approximation of the mechanical response corresponding to the fatigue life, in order to assess the stochastic properties, namely the statistical moments and the probability density function of fatigue life. The performance of the stochastic collocation method for dealing with this kind of problems has been evaluated through two numerical examples, showing the high performance for practical applications. Moreover, the proposed method is extended in the last example to the failure probability assessment, with respect to the target service life.
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